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February 29, 2000

Wendy Dixon, EIS Project Manager
Yucca Mountain Site Characterization Office
Office of Civilian Radioactive Waste Management
US Department of Energy
PO Box 30307, Mail Stop 010
North Las Vegas, Nevada 89036-0307

RECEIVED
MAR 03 2000

Dear Ms. Dixon,

1 In a previous DOE publication various aspects of handling high-level nuclear wastes were studied:
Nuclear Wastes: Technologies for Separations and Transmutation, Committee on Separations Technology and Transmutation Systems, Board on Radioactive Waste Management, Commission on Geosciences, Environment, and Resources, National Research Council, published by National Academy Press, Washington, D.C. ©1996 by the National Academy of Sciences.

Due to the lack of knowledge, on the part of the contractors for this study, the conclusion was that there is no known method of handling high-level nuclear wastes that is more cost-effective that geological storage. This publication and this study is the basis for the plans for storing high-level nuclear wastes in YUCCA Mountain.

Enclosed is a technical article describing new technology that appears to have the capability of on-site stabilization of high-level radioactive wastes.

This information is being provided to all Congresspersons and Senators who are on committees dealing with this important topic.

Don't you believe that the on-site transmutation of high-level radioactive wastes can be much better than the politically unacceptable and highly-expensive packaging, transportation, and long-term storage. Please provide me with your view.

Sincerely,

Harold L Fox

Harold L. Fox, President and Editor, *Journal of New Energy*

ON-SITE STABILIZATION OF RADIOACTIVE WASTES

By Hal Fox, Editor, *Journal of New Energy*[1]

ABSTRACT

An energy revolution has begun. Several new-energy devices are now being commercialized. This paper discusses one of the most promising of these new technologies: **high-density charge clusters** also known as the Shoulders-Ilyanok-Mesyats-Gleeson technology. An important application of this technology is the transmutation of high-level radioactive wastes in both liquids and solids. In addition, several other applications are briefly discussed. These applications of high-density charge clusters include thermal energy, direct electrical energy, and the possible production of some scarce elements from more plentiful elements.

A. INTRODUCTION

The many decades of burning of fossil fuels has contributed a great deal of pollution to our environment. Some scientists report holes in the ionosphere. Other scientists report considerable damage to our breathable air, especially near large industrial areas and along heavily-traveled highways and freeways. In addition, there is a big problem in the disposal of radioactive wastes coming from nuclear power plants and from nuclear-weapons-related activities.

Two major types of development are needed. First is the production of new-energy sources which are non-polluting, inexpensive, and abundant. These new-energy sources need to provide both thermal and electrical energy. The second type of development is the proper handling of high-level radioactive materials. The emphasis of this paper is on this last topic.

This paper briefly describes one of the emerging new technologies -- the use of high-density charge clusters. This new Shoulders-Ilyanok-Mesyats-Gleeson discovery can be applied to the production of thermal and electrical energy and, in addition, be used for the **on-site stabilization of high-level radioactive wastes.**

B. BRIEF HISTORY OF CHARGE CLUSTER DISCOVERY

In the 1980s, Kenneth Shoulders discovered and developed the high-density, electron, charge-cluster technology. His major applications were for the use of this technology in very high speed digital computers. Several patents [1] have been issued and one book has been written [2] describing this technology. The first patent [1] makes the following unusual statement: "An EV [charge cluster] passing along a traveling wave device, for example, may be both absorbing and emitting electrons. In this way, the EV may be considered as being continually formed as it propagates. In any event, energy is provided to the traveling wave

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output conductor, and the ultimate source of this energy appears to be the zero-point radiation of the vacuum continuum." This is the first patent known to this author to cite that the energy of space was being tapped!

A few years later, Prof. A. Ilyanok, discovered and developed some new applications for high-density charge clusters [3]. After an additional few years, Dr. Mesyats (a Russian scientist) discovered high-density charge clusters and named them "Ectons" [4]. Mesyats presented his paper in the XVIIth International Symposium on Discharges and Electrical Insulation in Vacuum. It was an interesting meeting in which Kenneth Shoulders was present. Of course, Shoulders shared the information with Dr. Mesyats that the technology had already been patented in the U.S.

About six years ago, the late Stan Gleeson, a high-school graduate (with intense scientific interest), using a crude laboratory in the corner of a welding shop in Cincinnati, Ohio, discovered a method of making and using high-density charge clusters in a water solution [5]. Gleeson contacted the author and considerable scientific development of this particular technology was accomplished at Trenergy's laboratory in Salt Lake City, Utah under the direction of Dr. S-X Jin, Chief Scientist. Several important scientific papers were published as a result of this development [6,7,8].

C. DESCRIPTION OF CHARGE CLUSTERS

A high-density charge cluster can be formed by providing a short voltage spike on a pointed electrode. See Fig. 1. The voltage used ranges from about 100 volts to several thousand volts. One important feature is that the voltage spike applied to the cathode should be in the range of a nanosecond duration. The typical charge cluster is about one micron in diameter. The single clusters range in size from about 0.5 to 3 microns. The cluster probably forms a toroidal structure; at least, from an analytical standpoint, such a toroid has been shown to have stability [8]. The electrons moving at near-light velocities around the outer surface of the charge cluster toroid creates a strong magnetic field. The electrons create the magnetic field and the magnetic field stabilizes the electron flow.

Charge clusters are rarely produced as a single cluster. Typically, 20 to 80 of these charge clusters form in a "necklace" (to use Shoulders' designation) [2]. The diameter of a typical necklace is 20 microns. See Fig. 2. The use of stronger input electrical energy can create another size cluster that is about 50 microns in diameter. Dr. Ilyanok has performed considerable experiments with 50-micron charge clusters [3]. However, charge clusters contain typically 10^{11} electrons in a one-micron cluster. All clusters and necklaces of clusters are unstable on the surface of a conductor. When the charge cluster impacts an anode, there will be a burst of electromagnetic radiation (also called an electromagnetic pulse or EMP). The EMP from a 50-micron cluster can damage transistors **in equipment not connected to the experiment!**

Assume that a charge cluster is produced in a low-pressure hydrogen atmosphere. The very high local electric field from the charge cluster will ionize the hydrogen atoms. The resulting protons will, of course, be attracted to the highly negatively-charged cluster. The end result is about 100,000 to one million protons traveling with and being accelerated in an electric field produced by the voltage on the anode. If this voltage is about 5,000 volts, the velocity of the combined charge cluster will be about one-tenth the speed of light. See Fig. 3. At this velocity (proton kinetic energy) nuclear reactions can occur. Protons (in a combined charge cluster) accelerated by voltages ranging up to 50,000 volts (about the same as used in a medium-size television set for the picture tube) will have sufficient impact energy to produce nuclear reactions with all elements. See Fig. 4.

Other applications of high-density charge clusters can be used to create thermal energy. If the charge cluster is properly accelerated through a coil, then direct electrical energy can be produced. According to Kenneth Shoulders, electrical energy as high as one hundred times the input electrical energy has been produced in the laboratory. Data sources showing electric energy output of about 30 times the input electrical energy are cited in Shoulder's first patent [1].

D. TRANSMUTATION OF RADIOACTIVE WASTES

From the standpoint of cleaning up the environment, the production of clean, abundant, and inexpensive energy from the use of the charge cluster technology is, of course, highly important. For this paper, the author emphasizes the use of the high-density charge clusters for the proper handling of high-level nuclear wastes.

The discovery made by Stan Gleeson has been developed into demonstration equipment that can remove radioactive elements from a water solution [5,6,7]. In a simplified description this achievement consists of the following components. First is the use of metal electrodes which produce a high-resistant oxide layer in an electrochemical process. The concept is that nearly all of the voltage drop in such an electrochemical process occurs across the thin, metal-oxide layer. Under appropriate conditions, the high voltage gradient across the metal-oxide layer caused local catastrophic disruptions of the thin oxide layer and the emission of a visible **spark-like emanation**. Under proper temperature and pressure conditions in an enclosed reactor, the generated charge clusters transmute nuclei of materials dissolved in the solution. For example, naturally radioactive thorium has been almost entirely removed from a water solution in a special reactor in less than one hour of processing time [7]. It is proposed that this method be further developed into commercial reactors and used for **the on-site stabilization of high-level radioactive solutions.**

It is well known that proton accelerators, having the proper kinetic energy, can be used to bombard some types of radioactive solids and cause transmutation of such radioactive materials into stable elements. In some cases, it is proposed that such proton accelerators be used to produce neutrons to transmute radioactive materials.

As shown in Fig. 4, a properly accelerated charge cluster carrying a load of protons can impact radioactive target nuclei and cause an immediate disruption of the nuclei and the production of two (or more) nuclear fragments. An analysis of the density of the protons that can be attracted to and be accelerated with the combined charge cluster shows that the positive-ion density on target can be many times larger than the positive-ion density of any contemporary positive-ion accelerators [9]. As mentioned above, a voltage of 5,000 volts can impart about one-tenth light velocity to the combined charge cluster. To accelerate protons

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to one-tenth light velocity in a proton particle accelerator would require about nine million volts. Therefore, further development of this technology is expected to provide equipment than can be used for the **on-site transmutation of high-level radioactive solids.**

E. ECOLOGICAL IMPACT

We are now nearing the commercialization of important new technology. In this paper we have selected one such new-energy technology to describe. The discovery of high-density charge clusters **that get their excess energy apparently from tapping the vacuum energy (also known as space energy, zero-point energy, etc.)** is important. It is the author's professional judgement that this new-energy source is one of the major discoveries of the 20th century.

As the applications of high-density, charge-cluster technology are used to produce thermal and electrical energy, there will be less fossil fuels burned. Every megawatt of energy produced by charge-cluster technology can be one megawatt less produced by the burning of fossil fuels. The end result will be a cleaner environment.

The use of this new technology for the **on-site stabilization** of high-level radioactive wastes can mean the end of transportation and geologic storage (for thousands of years) of these dangerous materials. This technological development should be greatly welcomed by the nuclear power industry and by all of those concerned for the world's ecology.

High-density, charge-cluster technology is presented, therefore, as one of the most ecologically-important, new-energy discoveries. The challenge is to get this new technology accepted by more members of the scientific community and by those private (and public) entities who fund new developments.

The importance of this new technology to the stabilization of high-level radioactive wastes has been demonstrated in the laboratory for liquids [6,7,8]. The use of this technology for the transmutation of spent-fuel pellets has been shown by mathematical analysis to be about one million times better (in terms of positive-ion density on target) than any current particle-accelerator technology [9].

It is deemed important that information concerning on-site stabilization of radioactive wastes be made available to political and community leaders. There can be the savings of many billions of taxpayer dollars in developing and using this technology for the on-site transmutation of high-level radioactive wastes. There is no longer any justification for the potentially-dangerous packaging, transportation, and storage in Utah or Nevada of these dangerous radioactive wastes.

For those who claim that there is no danger in handling these radioactive wastes, the following short note in the *Wall Street Journal*, Monday, January 31, 2000, page 1 may be of interest:
"*U.S. nuclear workers suffered illnesses and early death because of their work on the nation's weapons program, the U.S. admitted Saturday in a reversal of its long-held position. The decision, after a review of data covering an estimated 600,000 workers, may open the door to compensation claims.*"

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[Note: The author welcomes your support and suggestions on getting this new technology further known and further developed.]

ACKNOWLEDGEMENTS
The author acknowledges the financial support from **Emerging Energy Marketing Firm, Inc.** for the preparation and presentation of this paper. Also, the author thanks Dr. S-X. Jin, Chief Scientist for Trenergy, Inc. whose professional efforts have greatly enhanced our technical understanding of the Shoulders-Ilyanok-Mesyats-Gleeson discoveries.

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[2] Kenneth R. Shoulders, EV, A Tale of Discovery, c1987, published and available from the author for $200, P.O. Box 243, Bodega, CA 94922-0243.

[3] Personal communication with Prof. Ilyanok in Minsk, Republic of Belarus.

[4] G.A. Mesyats, "Ecton Processes at the Cathode in a Vacuum Discharge," *Proceedings of the XVIIth International Symposium on Discharges and Electrical Insulation in Vacuum*, July 21-26, 1996, Berkeley, Calif., pp 720-731, 38 refs, 10 figs, 5 tables.

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[9] Shang-Xian Jin and Hal Fox, "High-Density Charge Cluster Collective Ion Accelerator," *Jrnl. of New Energy*, Vol 4, No 2, Winter 1999, pp 96-104, 47 refs, 4 figs, 3 tables.

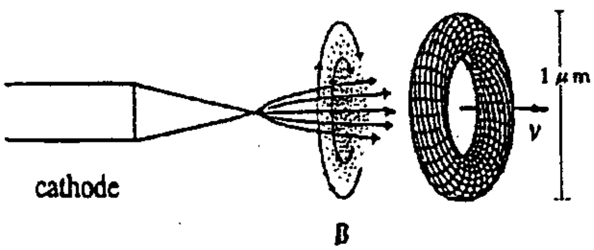

Fig. 1 Charge cluster formation

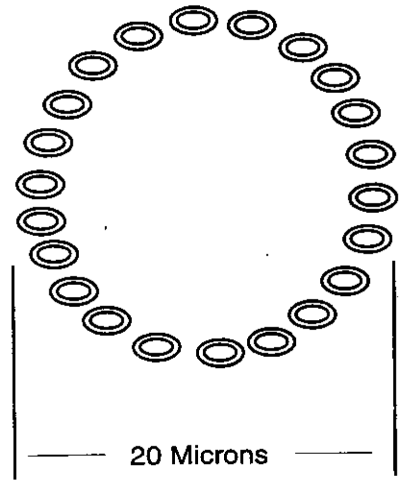

Fig. 2. Necklace of Charge Clusters

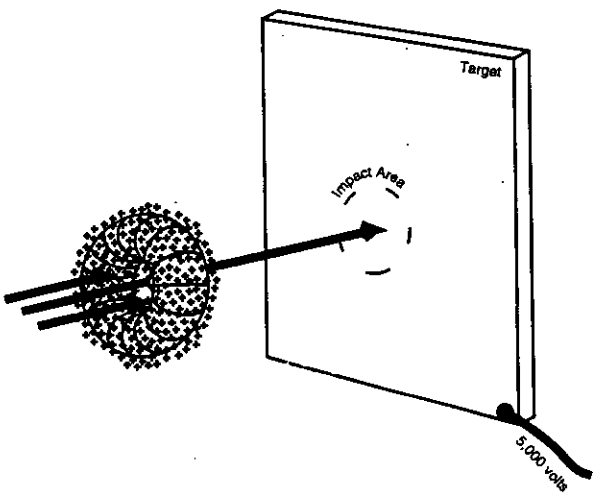

Fig. 3 Charge Cluster in Accelerating Field

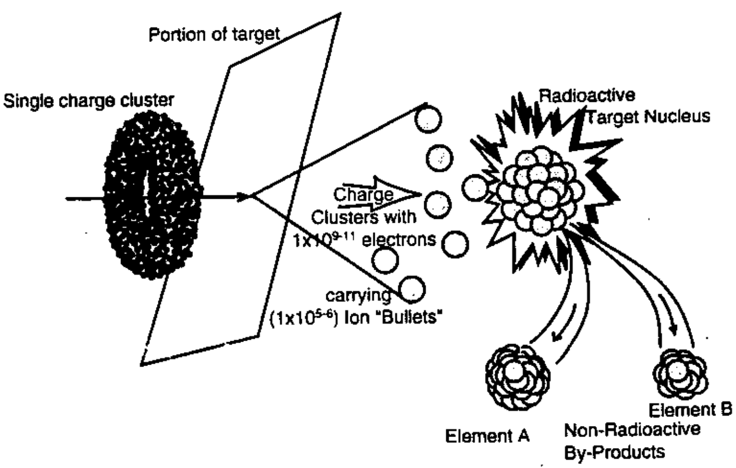

Fig. 4 Impacting charge cluster creates low-energy nuclear reaction